

GeoLab in NASA's Pressurized Excursion Module: First Results from the 2010 Field Trials

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Before humans explore other planets, NASA must develop advanced techniques for collection, preservation and return of unique extraterrestrial samples. To help evaluate hardware requirements and operational concepts for future sample-return missions, we designed and built GeoLab – our first generation lab for geological samples – into NASA's Habitat Demonstration Unit in the Pressurized Excursion Module (HDU1-PEM). The center of GeoLab is a glovebox for the examination of samples in a shirt-sleeve environment. As part of a deployable habitat, GeoLab can participate in NASA's analog missions that simulate planetary exploration activities and support the testing of relevant technologies for collecting and handling geological samples. Over time, these tests will evaluate sample handling environments (field and lab), sampling tools and analytical instruments, and different scenarios involving both robotic and human procedures.

The GeoLab design supports evolving tests and configurations. The glovebox is mounted on the habitat bulkhead, with three sample pass-through chambers that allow for direct sample transfer into the glovebox from the outside. The glovebox design and construction (low-particle shedding, minimally off-gassing materials) provides a clean environment to reduce sample contamination; in the future, we will integrate a positive pressure, enriched nitrogen atmosphere. The glovebox is equipped with configurable instrument ports. The 2010 test included a mass balance, a stereomicroscope with a HD camera for detailed imaging of samples, and a handheld XRF analyzer for preliminary geochemical characterization of samples. Network cameras provided context imagery and sample handling activities.

We present early results from the initial field trial of GeoLab during the 2010 Desert Research and Technology Studies (D-RATS) planetary analog test near Flagstaff AZ. The 2010 D-RATS mission involved two rovers, the habitat with GeoLab, four crew members, and a team of scientists and flight controllers. The crewed rovers conducted geological traverses and collected samples on the "planetary" surface. Selected samples were transferred into GeoLab for detailed examination and initial analysis, providing critical data to the science team for evaluation and prioritization of samples.